Longitudinal Loneliness and Its Risk Factors among Older People in England

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ABSTRACT

This paper studied the longitudinal trajectories of loneliness with ageing and models the effects of relevant risk factors. Data came from the second to the sixth waves (2004/5 – 2012/13) of the English Longitudinal Studies of Ageing (ELSA). Respondents who participated in at least two waves and offered valid responses to the UCLA three-item loneliness scale were included (baseline n=9,171). While statistics describing the inter-wave changes confirmed the longitudinal stability of loneliness among older people, serious attention should be paid to the small percentage of older people who are 'longitudinally lonely'. Self-reported health and relations with spouse and children were significant risk factors, and it was the change of closeness to spouse rather than the loss of spouse that most affected the change of loneliness scores. Future research should aim to identify personal and social events that make older people lonely over a long period of time.

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Keywords: Loneliness, English Longitudinal Study of Ageing (ELSA), UCLA loneliness scale, Family relations

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Loneliness is “an unpleasant experience [that] occurs when a person's network of social relations is deficient in some important way, either quantitatively or qualitatively” (Perlman & Peplau, 1981, p.31). It could induce a number of detrimental effects on physical as well as mental health, such as a heart attack (Ong, Rothstein & Uchino, 2012), high blood pressure (Hawkley, Thisted, Masi & Cacioppo, 2010), depression and dementia (Cacioppo, Hawkley & Thisted, 2010; Prieto-Flores, Forjaz, Fernandez-Mayoralas, Rojo-Perez & Martinez-Martin, 2011). Older people have been identified as most vulnerable to loneliness, and a number of risk factors have been identified, including, for example, widowhood (Russell & Taylor, 2009), poor physical health and increasingly limited physical abilities (Korporaal, Marjolein, van Groenou, & van Tilburg, 2008), the decrease of intimate social relations (Heylen, 2010), and societal or cultural factors (De Jong Gierveld & Havens, 2004; Lykes & Kemmelmeier, 2014; Yang & Victor, 2011). In addition, socioemotional selectivity theory (SST) posits that older people value close, emotional and meaningful relations more than other matters in life as their time-span starts to shrink (Carstensen, 1992; Löckenhoff & Carstensen, 2004). The implication of SST for the study of loneliness is that the increased priority of intimate relations would make older people more vulnerable to loneliness – while they expect more from their social relations, the number of their intimate social relations may have already started to diminish due to widowhood and having an empty nest.

How loneliness changes over time is a very important dimension of this socially-originated form of mental suffering. People who are regularly lonely over a sustained period of time are expected to be more vulnerable than those who suffer from “bouts” of “transient loneliness”. In other words, loneliness has serious medical implications only when it becomes “chronic” (Cacioppo & Patrick, 2008, p.5). Therefore, it is useful to distinguish “cross-sectional loneliness”, which measures a respondent’s loneliness at one time point or during a very short period of time, from “longitudinal loneliness”, which measures the temporal

attributes of loneliness, such as the duration of each episode of loneliness, the number of loneliness episodes, and the pattern of relapses over a long period of time. This conceptual distinction could help us better understand the nature of loneliness: the longer the sense of loneliness lasts, the more likely it is a trait rather than a state. It is in the spirit of discovering these longitudinal attributes of loneliness that this study has been conducted, although to determine whether the loneliness under study is a trait or a state is beyond this study.

Most empirical studies of loneliness analyse data collected from cross-sectional surveys (e.g., Dykstra & Fokkema, 2007; Stevens & Westerhof, 2006; Victor & Yang, 2012), because for a long time, longitudinal data on loneliness were hard to come by. "In the United Kingdom, the dearth of longitudinal studies of loneliness is acute…" (Victor & Bowling, 2012, p. 315). For other European nations and the USA, the number of longitudinal studies on loneliness among older people was not large either (Dykstra, van Tilburg & De Jong Gierveld, 2005). Furthermore, without referring to any temporal features of the lonely experience, the most widely used loneliness scales, the UCLA scale (Russell, 1996) and the De Jong-Gierveld scale (De Jong Gierveld & van Tilburg, 2010) measure loneliness at the time when the respondent was interviewed. Some single-item loneliness instruments do provide a time frame, such as "the past week" in the European Social Survey; however, such a time frame is clearly highly restrictive.

During the past decade or so, some progress has been made in studying loneliness with longitudinal data. For example, analysing data collected from 939 men born from 1900 to 1920 in the Dutch town Zutphen, Tijhuis and colleagues (1999) found that loneliness scores increased for the older group but not for the younger one, and that losing their spouse and moving into a care home were two significant risk factors. Victor and colleagues (2009, p. 146-150) reviewed six longitudinal studies of loneliness published at the turn of the new millennium, reporting that while two studies saw loneliness increasing with age, others

reported a more stable pattern over time. Later, Victor and Bowling (2012) conducted a follow-up study (1999/2000 to 2007/8) of 287 people aged 65+ in Britain and discovered a highly stable pattern of the prevalence of loneliness across the eight-year period, which is broadly consistent with results from other longitudinal studies. In the US, analysing the data collected from the Chicago Health, Ageing and Social Relations Survey (CHASRS), Caccioppo et al (2010) found that the mean score of the UCLA Loneliness Scale (UCLA-R) remained around 35 to 36 over the five year period from 2002 to 2006. There are, however, exceptions to such longitudinal stability of loneliness. For example, from 1988 to 2004, some Finish researchers (Heikkinen & Kauppinen, 2011) followed several hundred older residents in Jyväskylä, and found the prevalence of loneliness significantly increasing over the 16-year period.

The English Longitudinal Study of Ageing (ELSA) is another valuable source of data for studying loneliness longitudinally. It has a nationally representative and large sample, and it has multiple waves covering a long time span for studying longitudinal patterns of loneliness among older people. Analysis of such a dataset would also enable researchers to discover whether the risk factors found significant in cross-sectional studies remain so longitudinally. While this is not the first study that analyses the ELSA data for studying loneliness, other researchers analysing this dataset have not revealed longitudinal trajectories of loneliness and related risk factors because they were concerned with other issues. For example, some analysed the data collected in the second wave of ELSA alone (Shankar, McMunn & Banks, 2011; Steptoe et al, 2013), leaving the longitudinal features of loneliness untouched, since it was the first wave that included measures on loneliness. Chou and colleagues (2014) analysed the data collected from two waves of ELSA (2003/4 and 2006/7) and discovered the interactive effect of the CRHR1 gene with a lack of support from adult children on loneliness among older adults in England. Analysing only two waves of data, such studies could not show the shape of the 'process of change', nor could they distinguish true change from measurement errors

(Singer and Willett, 2003, p.10). Shankar and colleagues (2015) analysed multiple waves of the ELSA data, but they treated loneliness as an explanatory variable of physical as well as mental wellbeing. Another recent study analysed a sample of survivors in waves 2 to 6 of ELSA (Pikhartova, Bowling & Victor, 2016), but its focus was the effect of the respondents' expectations of loneliness on the actual level of loneliness rather than which risk factors affected the respondents' longitudinal loneliness.

Analysing the sample of all respondents who participated in two or more waves of ELSA, and taking the UCLA three-item summed score of loneliness as the response variable, this study aims to make the following contributions: (1) to reveal the patterns of longitudinal loneliness; (2) to test the longitudinal stability of loneliness; (3) to discover whether the risk factors identified in cross-sectional studies remain statistically significant longitudinally. The third contribution is perhaps the most significant. In particular, most existing studies focus on the presence or absence of the respondent's social relations, for example, living with spouse or children. This study goes a step further by examining whether the perceived closeness of the respondent's relations with their spouse (or partner), and the number of children, other family members and friends that they felt close to, affected their chance of feeling lonely.

Data and methods

Sources of data

Data for this study came from waves 2 to 6 of ELSA, whose samples were drawn from the Health Survey for England (HSE). The target population were those aged 50+ in England. The first wave started in 2002, and the following waves were conducted subsequently every two years. Wave 2 was the first that included measures of loneliness and is used here as the baseline, with a valid sample size of 9,171. Since the third wave, a refreshment sample of about one to two thousand was added in order to make up for attrition. Steptoe et al produced a detailed cohort profile of ELSA, and acknowledged that '[t]he analysis of response rates and

attrition from ELSA is complicated because of variations in responses to different elements of the study, deaths and differences between core and refreshment cohorts' (2013: 1642). According to their analysis, attrition rates varied from about 20 per cent to 40 per cent. They and other researchers (Banks, Breeze, Lessof & Nazroo, 2006; Marmot, Banks, Blundell, Lessof & Nazroo, 2003) confirmed that those who failed to continue to participate 'tended to be older, less wealthy, less educated' but 'more likely to come from a non-managerial occupation and suffer from a limiting long-standing illness' (ibid.). The dataset for this study included all respondents who participated and offered valid responses to the loneliness questions for two or more waves. It is therefore sensible to expect that the respondents included in this study were less lonely than those who dropped out.

Measurement of loneliness

This study used the three-item UCLA loneliness scale:

(1) How often do you feel you lack companionship?

(2) How often do you feel left out?

(3) How often do you feel isolated from others?

For each question, the respondent could choose one of the following options: 1='Hardly ever or never', 2='Some of the time', and 3='Often'. Thus, the summed score of these three items ranged from 3 to 9, with a higher score indicating a higher level of loneliness. This short scale had good internal reliability (Cronbach's $\alpha = 0.82$) as well as strong and positive correlations with the full UCLA loneliness scale (Hughes, Waite, Hawley & Cacioppo, 2004).

Covariates

Three sets of covariates widely recognized as risk factors for loneliness in the literature were included in the following statistical analyses. The first contained three demographic variables: gender, age (capped at 90 and centred at its grand mean), and marital status (simplified into four categories: 1='Single', 2='Married or civil partnership', 3='Separated,

divorced, or dissolved', and 4='Widowed'). The second set included two variables related to health: self-reported general health conditions (5='Excellent', 4='Very good', 3='Good', 2='Fair', and 1='Poor') and whether the respondent had a limiting long-term illness (1='Yes', 0='No'). The third set contained four variables describing the quality and the quantity of the respondent's social relations: how close they felt they were to their spouse (or partner) (4='Very close', 3='Quite close', 2='Not very close', and 1='Not at all close'), and the number of children, the number of family members, or the number of friends they had close relationship with, respectively. These were all inherently quantitative variables, although their actual values were limited.

Missing values

As 'participants who drop out between ELSA waves have been shown to be less healthy, wealthy, socially connected and more lonely than those who remain in the study (Scholes, Taylor, Cheshire, Cox, & Lessof , 2008; Shankar et al., 2011; 2013) and report poorer well-being' (Shankar et al., 2015), the missing values of the variables were very likely not missing at random. In addition, as shown below, the distribution of the summed score of the three-item UCLA scale was not normal. Thus, multiple imputations for missing values were not implemented (Leech, Barrett & Morgan, 2015, p.293). Cases without a valid summed score of the three-item UCLA scale – at least one of the three items was missing – were excluded from the subsequent analyses. The number of such cases increased from 1,263 at wave 2 to 4,421 at wave 6.

Statistical methods and models

The number of wave was used as a metric of time. Bivariate statistics were produced for describing the longitudinal changes between two consecutive waves, and generalized linear mixed models were constructed to measure the effects of the covariates on loneliness over the five waves. Three statistical models were constructed and estimated for different purposes. The

first included time and selected predictors of loneliness. A second model took the change of the loneliness score as the response variable with the change of selected predictors as explanatory variables. Longitudinal sampling weights were applied for the calculation of the descriptive statistics but not for the mixed effects models presented below.

Hypotheses

The statistical analyses were conducted to test the following important hypotheses:

Hypothesis 1: There was no significant change of the mean scores of loneliness from wave 2 to wave 6.

Hypothesis 2: Correlations of cross-wave loneliness scores remained high (above 0.5) and consistent over time.

Hypothesis 3: The probability of feeling often lonely over time among the married was statistically significantly lower than that among those of other marital statuses.

Hypothesis 4: Closeness to spouse (or partner) had a statistically significant effect on often feeling lonely over time.

Hypothesis 5: Good self-reported general health significantly lowered the probability of feeling often lonely over time.

Hypothesis 6: Having a limiting and long-term illness significantly increased the probability of feeling often lonely over time.

Results

Descriptive statistics

[Insert Table 1 about here.]

The mean (or percentage) and standard deviation for each variable at each wave of ELSA are presented in Table 1. The mean of the response variable 'summed score of the three-item UCLA loneliness scale' increased from 4.11 at wave 2 to 4.19 at waves 2 and 3, and then

declined slightly to 4.16 and 4.17 at the last two waves, respectively, which suggests an overall longitudinal non-linear increase of the average level of loneliness.

The mean of age did not increase by exactly two years across two consecutive waves, because it depended on who participated in these waves. The percentage of males remained extremely stable across the waves at around 45 per cent. Not surprisingly, the percentage of married respondents and those in civil partnerships slowly declined from 66 per cent at wave 2 to about 63 per cent at wave 6; those widowed increased gradually from 18 per cent to more than 21 per cent; and the percentage of the divorced and the singles remained about the same over the waves. The scores of self-reported general health followed the same longitudinal pattern as that of loneliness scores: going up at waves 2 to 3 and then declining at the remaining three waves. The percentage of respondents with an illness that limited their daily life remained in the range of 63 per cent to 67 per cent, increasing slightly over the first three waves and more rapidly at the last two waves. The respondents who were married (or in a civil partnership) felt very close to their spouses: the mean stayed at 3.7 for all waves, very close to the maximum (4). On average, the respondents had more than two children, more than two other family members, and about three to four friends to whom they felt close, which, like most other factors, showed a very high level of longitudinal stability.

Testing growth trajectories

For the studied sample, the equal variance and covariance hypothesis was rejected as Mauchly's test of sphericity was highly significant (W=0.889, df=9, and p<0.001). The corresponding F test of equal means over time was highly significant as well (F=9.927, df=4, and p<0.001), providing strong evidence for rejecting the first hypothesis of equal means of the loneliness scores over time. Thus, the construction of the following mixed effects models on the summed longitudinal loneliness scores was justified.

Between-wave correlations of the summed loneliness scores

[Insert Table 2 about here.]

To reveal how the summed loneliness scores changed across two consecutive waves, the percentages of three types of between-wave scores (decrease, no change, and increase) were presented in Table 2: about 21 per cent of the respondents' loneliness scores decreased between two consecutive waves, 55 per cent had no change, and 23 per cent increased. In addition, given that the distribution of the summed loneliness scores was strongly skewed to the right (that is, at every wave the percentage of respondents quickly declined with the increase of loneliness score, results omitted), Spearman's rather than Pearson's correlation coefficients were produced (the fourth row of Table 2). These coefficients, all around 0.6, indicate a relatively strong and stable between-wave correlation of loneliness scores, thus lending support for Hypothesis 2.

Mixed effects models on the summed loneliness score

The skewness of the summed loneliness scores' distribution made it sensible to recode the scores into ordered categories, a strategy adopted in Shankar et al (2015) who recoded the scores into two categories. Here, it was recoded into three categories: 'never lonely' (3), 'sometimes lonely' (4 – 6), and 'often and always lonely' (7 – 9). Two ordinal mixed logistic regression models were then constructed, with 'often/always lonely' as the reference category (Table 3).

[Insert Table 3 about here.]

The first model was a binary logistic regression model that contrasted those who were 'never lonely' with those 'often or always lonely', and the second contrasted the 'sometimes lonely' with the 'often or always lonely'. Results for the two models were clearly very consistent. Perhaps the first important observation was that neither time (wave number) nor age was statistically significant. The interaction terms between time and each of the predictors

were then added to this model; there is no need to present the results here, however, as none of the terms was statistically significant, confirming that the predictors did not depend on time.

For the effects of marital status, with 'the widowed' as the reference category, the singles and the divorced or separated had no statistically significant effects on the relative chance of feeling lonely in both models. The married (or in civil partnership), in great contrast but perhaps not surprisingly, enjoyed a statistically significant chance of not feeling lonely often with reference to the widowed, lending support to the third hypothesis. Moreover, how close the respondent felt to their spouse or partner was highly significant, and this is true for both models, giving support to the fourth hypothesis. In other words, what matters was not merely that an older person was married (or had a partner) but also the quality of the relationship: the perceived level of closeness of their relationship with spouse (or partner) greatly enhanced the chance of being never or only sometimes lonely as opposed to often or always being lonely. The number of children an older respondent felt close to was also statistically significant for both models, although to a lesser extent in terms of both the magnitude and the level of statistical significance. The number of other family members an older respondent felt close to was not statistically significant, while the number of friends an older respondent felt close to was statistically significant for being 'never lonely' at the 0.05 level but not so for being 'sometimes lonely', relative to 'often and always lonely'. Together, these results pointed to an emerging hierarchy of social relations in terms of their effects on the level of loneliness: the relationship with spouse or partnership was the most important, followed by those with children, friends, and other family members, offering new empirical evidence to a theory of a similar hierarchy of social support to people in stress (Kahn & Antonucci, 1980).

For the two health predictors, 'self-reported general health' was highly significant – the better the perceived health, the more likely an older respondent would feel never or sometimes

lonely as opposed to feeling often or always lonely. This was not the case for having a health condition that limited the daily life of the respondent, which was only significant for 'never lonely' in comparison with 'often or always lonely'. Thus, the fifth hypothesis gained some supporting evidence, while the sixth did not.

The effects of the changes of predictors on the change of loneliness scores

The above models did not directly take the change of the loneliness scores as the target; rather, they took their values as the direct target although they took into account the clustering effect of these scores over time for each respondent. To model the effects of the changes of selected predictors on the cross-wave change of loneliness scores, a new dataset was created. For loneliness, the change score equals the score at wave n minus the score at wave (n-1). These differences were then recoded into three categories (increase if the change score was positive, indicating more frequent or worsening loneliness, no change if the changes score was zero, and decrease if the change score was negative, for less frequent or improving loneliness). The purpose of this section was to discover which predictors were responsible for the changes of loneliness scores among older people in England. Change of age was not included anymore as it was constant. Gender was included as a fixed control variable. The change of each of the following predictors was included as predictors: having a spouse (or partner), self-reported general health, having a limiting long-term illness, closeness to spouse/partner, number of close children, number of close family member, and number of close friends. As the interest shifted to the changes of these predictors, their values were all recoded into three categories: increase, no change, and decrease (results presented in Table 4).

[Insert Table 4 about here.]

Only two coefficients were found to be statistically significant in this model. The first was the intercept for the relative difference between the 'no change' group and the 'increasingly lonely' group; that is, when there was no change in all predictors of this model – i.e., all being

0, then a respondent was at least six times more likely to experience no change in their loneliness score over two consecutive waves, which was not surprising given that nearly 60 per cent of the respondents experienced no change in their loneliness scores. The second factor with a statistically significant coefficient was the change of the respondents' closeness to their spouse or partner. Feeling closer to their spouse or partner from one wave to the next increased the odds of having reduced frequency of loneliness by more than four times, and even having no change in the closeness of relationship to their partner across waves would increase the chance of decreased frequency of loneliness by nearly twice, which clearly showed the importance of the change of relationship with their spouse or partner in reducing the summed loneliness score. This lent further support to the fourth hypothesis. The changes of all other predictors were found statistically not significant.

Discussions

This study has revealed the longitudinal patterns of loneliness among older people and the effects of selected predictors in England over the time period of 2004 to 2012. The results were broadly consistent with those from other longitudinal studies of loneliness among older people (Holmen & Furukawa, 2004; Heikkinen & Kauppinen, 2011; Jylhä, 2004; Wenger & Burholt, 2004; Victor and Bowling, 2012). If scores of 3 and 4 in this study were taken as equivalent to the category of 'never or almost never lonely' in other studies, then about two-thirds of the respondents fell into this category, and the prevalence was remarkably stable (66.8% to 69.4%). For the 'severely lonely' or 'most frequently lonely' group, the percentages found in other studies were around 10 per cent; for this study, with the summed scores 7, 8, and 9 being classified as 'severely' or 'frequently', the percentages were in the range of 8.2 per cent to 9.7 per cent, very close to those in other studies; if only the score of 9 was classified as 'severely lonely', the percentage would decrease to about 2 per cent, which again remained almost the same over the eight-year period. Given the strong correlations between cross-wave

scores, this 2 per cent of older adults deserve the most attention: once they felt often lonely at one time point, it would be very likely that they felt the same two years later, and some of them would feel frequently lonely over the whole eight-year period.

On the other hand, some findings from this study were different from those of existing studies. First of all, the percentage of respondents whose scores experienced no change over time – about 55 per cent – was considerably lower than the 70 per cent reported by Dykstra and colleagues (2005) and Victor and Bowling (2012). Correspondingly, the percentages of 'increase' (or 'worsening', 23% to 25%) and 'decrease' (or 'improving', 21%) in this study were respectively much higher than those in the other studies (10% -15%). A series of factors could contribute to these differences across studies, one of which could be the more refined scale of the range 3 to 9 used in this study that captured more nuanced changes, in contrast to the categorical measurements used in most of other studies; other factors such as sampling scheme and sample size, timing of waves, and the measurements of loneliness could play a role as well.

Regarding the predictors for longitudinal loneliness, some of the results from this study were consistent with those in other studies, while others were not. First of all, given researchers' key interest in the longitudinal change of loneliness, the remarkable stability found in this study and others was in great contrast to the findings from cross-sectional studies (for example, Victor and Yang, 2012) – both loneliness itself and the effects of selected predictors including being female, self-perceived health conditions, illness with limiting effect, and closeness to spouse and children remained considerably stable longitudinally. The most notable difference between this study and others lay in the effect of marital status. While other researchers found the effect of the loss of a spouse or partner statistically significant for predicting loneliness (Dykstra et al., 2005; Heikkinen & Kauppinen, 2011), in this study, it was the perceived closeness to their spouses or partners in addition to the presence of their spouses

or partners that had a significant effect on the level of loneliness. One possible explanation could be that the difference between these findings could be attributed to the possibility that the effect of marital status was overwhelmed by the variable of 'closeness to spouse or partner' – the 'closeness' variable presumed no loss of spouse/partner and the percentage of respondents losing spouse/partner was very small. Thus, this study has provided new evidence for such an effect that was found in studies based on cross-sectional data (Dykstra & Fokkema, 2007; Stevens and Westerhof, 2006).

This study has several limitations. Perhaps the most important one is that although it revealed the longitudinal change of loneliness and analysed the longitudinal effects of selected predictors on the change of loneliness, it did not make use of the longitudinal order of the predictors when modelling their causal effects on loneliness. To do this, a separate study using longitudinal structural equation models will be needed. For the measurement of loneliness, ELSA contains two other single-item instruments, which were not analysed here due to limited space, although it was found that the single item and multi-item instruments were highly correlated and therefore interchangeable (Victor et al., 2009). In addition, the selection of the predictors was obviously constrained by the questions included in the original ELSA questionnaire; thus, theoretically important predictors found significant in other empirical studies, such as the number of confidants and migration, were not included here. Finally, the limited space meant that the paper could not present results using different measures of loneliness so that the robustness of the results could be examined.

Conclusions

The key findings of this study could be summarized in more general terms as the following. Fewer than one in ten older people in England felt often lonely, and this remained so throughout the years from 2004 to 2012. The distribution of older people across different levels of loneliness remained stable over time firstly because the loneliness of a little more than

half of older people did not change, while about one quarter became lonelier and the remaining one quarter became less lonely. The most worrying were those who remained very lonely consistently throughout the years, which constituted about 2 per cent of the sample, who deserve the most serious attention and interventions from those who have the responsibility of looking after them.

As the risk factors (or aetiologies) for loneliness, longitudinal loneliness and cross-sectional loneliness share the same factors of marital status, social relations, and health. More specifically, this study has confirmed that those married (or in civil partnership) were significantly less lonely over time than the widowed, those with more children and friends that they felt close to were less lonely than those who had fewer, and those who felt healthier were less lonely than those who were less confident of their health. What differentiates these two forms of loneliness was the role of spouse (or partner). Older people in England tended to value their relationship with their spouse more than any other social relations over time, most likely because both their time horizon and social networks were shrinking. In addition to having a spouse or partner, how close they felt to their spouse (or partner) was particularly responsible for longitudinal loneliness or a temporal increase in loneliness. Those who felt closer and closer to their spouse over time enjoyed a significantly reduced risk of loneliness.

Several implications could be derived from the findings of this study for practitioners and policy-makers in order to tackle loneliness among older people. Firstly, they are urged to target the 2 per cent of older people who frequently felt lonely over a long period of time (several years), as they were the most likely to become patients of more serious physical and mental illnesses listed at the beginning of this paper. Secondly, health conditions and relations with their own family members seemed to be the two most powerful factors affecting the likelihood and the longitudinal persistence of feeling lonely, which deserve serious attention when identifying potential victims and helping existing sufferers. Finally, while this study has

found that about 21 per cent of older people's loneliness was getting worse and another 23 per cent getting better over time, we still do not know much about why and how these changes happened. For example, an intriguing issue is that the attributes and strategies of older adults and their families that helped these adults grow out of loneliness might not be the same as those for preventing them growing into loneliness; in other words, the causal connections might not be symmetrical. Much research is needed to find out the exact mechanisms in different contexts.

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Tables and Figures

Table 1. Descriptive statistics by wave

	Wave 2		Wave 3		Wave 4		Wave 5		Wave 6	
	M (%)	SD	M (%)	SD	M (%)	SD	M (%)	SD	M (%)	SD
Loneliness	4.11	1.51	4.19	1.55	4.19	1.55	4.16	1.54	4.17	1.55
Age	66.39	10.26	67.78	10.02	69.12	9.52	70.41	9.17	72.41	9.17
Male	44.5		45.0		45.0		44.4		44.8	
Married	66.1		65.1		64.7		64.2		63.4	
Widowed	18.2		19.3		19.8		20.2		21.6	
Divorced	10.6		10.4		10.5		10.7		10.4	
Single	5.1		5.2		5.0		4.9		4.7	
Self-reported health	3.17	1.12	3.83	0.90	3.15	1.08	3.13	1.10	3.09	1.10
Limiting illness	62.7		63.2		63.8		65.0		67.1	
Closeness to spouse	3.72	0.54	3.72	0.54	3.70	0.56	3.73	0.54	3.71	0.56
Number of close children	2.15	1.13	2.13	1.08	2.10	1.10	2.12	1.10	2.09	1.10
Number of close family members	2.76	3.20	2.72	2.94	2.64	2.90	2.66	2.68	2.84	2.30
Number of close friends	4.43	6.86	3.74	4.17	3.61	3.10	3.71	3.33	3.58	2.99
N		7,908		6,381		5,495		5,313		4,750

Table 2. Percentage distribution of cross-wave summed score of three-item UCLA loneliness scale

	W2 → W3	W3 → W4	W4 → W5	W5 → W6
Decrease	20.64	21.32	21.98	21.08
No change	54.32	55.40	54.76	55.71
Increase	25.04	23.28	23.26	23.21
Spearman's correlation coefficient	0.628***	0.652***	0.643***	0.664***
n	5,943	4,901	4,604	4,382

***: $p < 0.001$

Table 3. Multinomial mixed logistic regression model on categorical loneliness score

Predictor	Never/often always lonely				Sometimes/often always lonely			
			95% CI				95% CI	
	Coefficient	Exp.	Lower	Upper	Coefficient	Exp.	Lower	Upper
Intercept	-6.552***	0.001	0.001	0.004	-2.413***	0.090	0.041	0.196
Time	-0.024	0.976	0.901	1.058	-0.003	0.997	0.921	1.078
Female	-0.421**	0.656	0.487	0.885	-0.337*	0.714	0.541	0.942
Age	0.018	1.018	0.999	1.038	0.007	1.007	.989	1.025
		0	0			0	0	
Single/widow	-0.071	0.931	0.476	1.791	-0.099	0.905	0.487	1.567
Married/widow	0.688***	1.990	1.398	2.458	0.571***	1.771	1.238	2.339
Divorce/widow	-0.043	0.957	0.482	1.688	-0.085	0.916	0.501	1.696
Health	0.708***	2.030	1.761	2.341	0.494***	1.639	1.430	1.879
No limiting	0.470***	1.599	1.199	2.134	0.158	1.171	.887	1.548
Closeness to spouse	1.792***	6.002	4.870	7.398	0.799***	2.224	1.862	2.655
Number of close children	0.220**	1.246	1.060	1.463	0.176*	1.193	1.024	1.390
Number of close family members	0.026	1.026	.972	1.083	-0.009	0.991	0.939	1.046
Number of close friends	0.062*	1.064	1.009	1.122	0.049	1.050	.996	1.107

***: $p < 0.001$; **: $p < 0.01$; *: $p < 0.05$

Table 4. Multinomial logistic mixed-effects model on change of loneliness score

Predictor	Coefficient	95% CI		
		Exp(coeff.)	Lower	Upper
Intercept for decrease / increase	.916	2.499	.491	12.726
Intercept for no change / decrease	3.438***	31.123	6.086	159.167
Female / male	-.040	.960	.863	1.069
New partner / loss of partner	2.170	8.757	.700	109.556
No change / loss of partner	1.542	4.675	.976	22.388
Improved health /deteriorated	.149	1.160	.956	1.408
No change / deteriorated	.066	1.069	.907	1.260
No limiting illness / new limiting illness	.023	1.024	.748	1.400
No change / new limiting illness	.000	1.000	.810	1.234
Closer to partner / away from partner	1.482***	4.400	2.806	6.899
No change / away from partner	.619***	1.858	1.357	2.544
More close children / fewer close children	.266	1.304	.921	1.846
No change / fewer close children	.054	1.055	.828	1.344
More close family members / fewer close family members	-.060	.941	.786	1.127
No change / fewer close family members	-.012	.988	.842	1.160
More close friends / fewer close friends	.030	1.031	.867	1.226
No change / fewer close friends	.032	1.032	.872	1.222